Use of POAM Data in the SOLVE-2 Campaign

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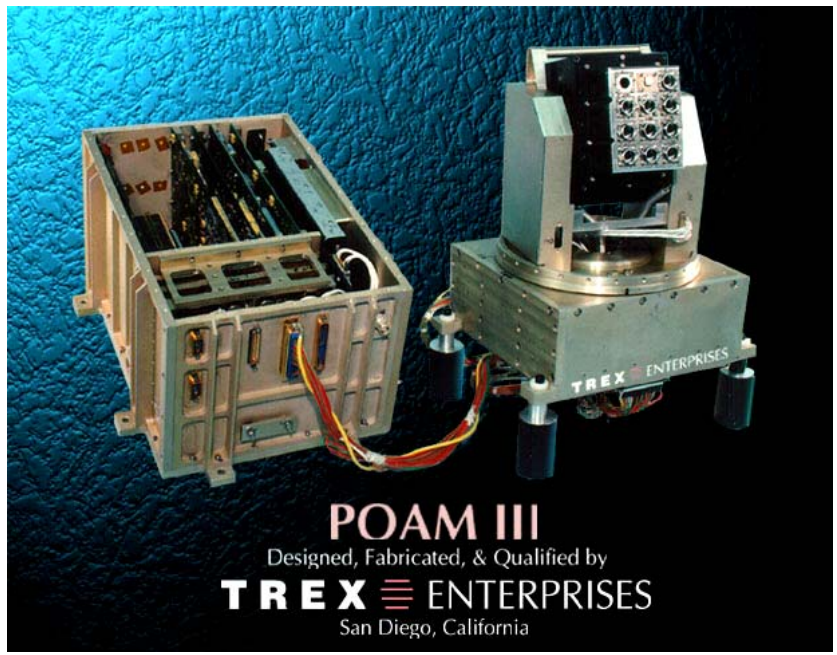
Polar Ozone and Aerosol Measurement (POAM III)

POAM III is a 9-channel visible/near infrared photometer for making measurements of stratospheric constituents using solar occultation techniques.

- The POAM measurement complement includes:
  - Ozone (10-60 km)
  - Aerosol Extinction (10-30 km)
  - Nitrogen Dioxide (20-40 km)
  - Water Vapor (10-40 km)
  - Oxygen (10-60 km)

- POAM III was launched on the SPOT 4 spacecraft on 21 March 1998 into a polar sun synchronous orbit (833 km, 98.7° inclination, 1030 equatorial crossing). The instrument is currently operational.

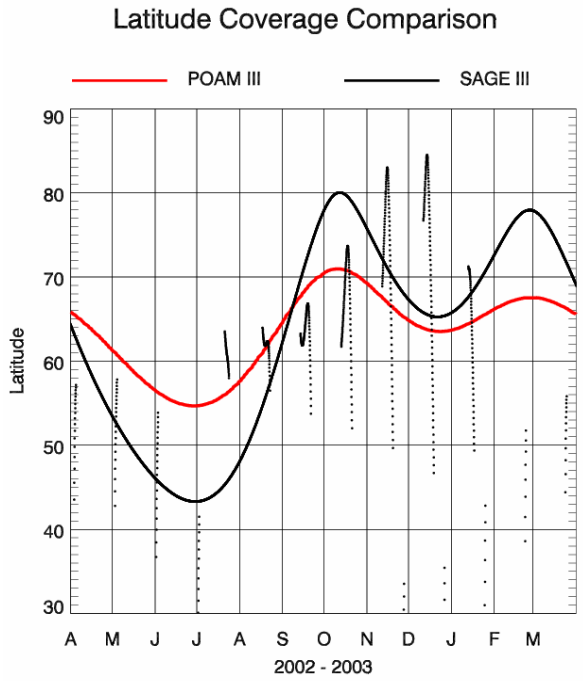
- POAM III is the successor to the POAM II instrument which operated from Oct. 1993 through Nov. 1996.



Use of POAM Data in the SOLVE-2 Campaign: Objectives

I. SAGE III Validation:

- POAM and SAGE III are in similar orbits.
- POAM and SAGE III use the same measurement technique (solar occultation) and wavelength range (vis/near IR), and measure the same constituents (O_3, H_2O, NO_2, aerosol extinction).
- POAM is now a mature and well validated instrument.



II. Value added science products made available to the SOLVE-2 team for flight planning

- Daily constituent maps, PSC catalog, … etc.

III. Pursue science studies with the SOLVE-2 data set:

- PSC type discrimination, ozone loss studies, etc

Use of POAM Data in the SOLVE-2 Campaign: Validation

POAM Version 3 Retrievals Validation References Summary

- **Ozone**

  Lumpe *et al.*, in press at JGR, 2002.
  Prados *et al.*, in press at JGR, 2002.
  Randall *et al.*, submitted to JGR, 2002.

- **Aerosols**

  Randall *et al.*, *JGR* 106, 27525-27536, 2001.

- **NO_2**

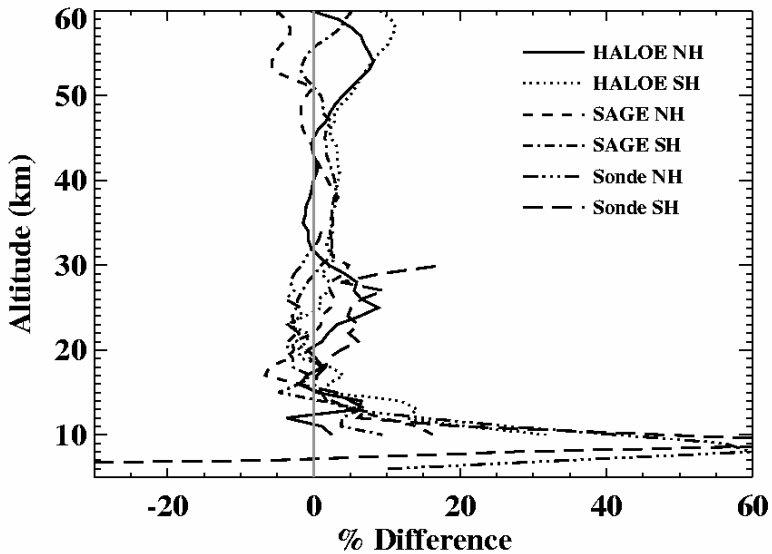
  Randall *et al.*, JGR 107, 2001JD001520, 2002.

- **H_2O**

  Nedoluha *et al.*, *JGR*, 107, 2001JD001184, 2002.
  Bevilacqua *et al.*, in preparation.

Use of POAM Data in the SOLVE-2 Campaign: Ozone

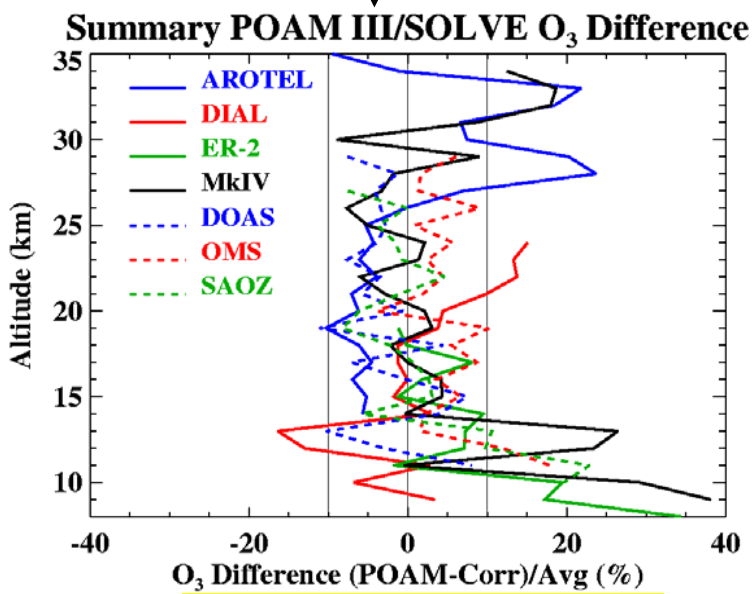
Comparisons with respect to POAM



Randall et al., JGR, 2002

- Satellite ozone measurements have demonstrated an accuracy of ±5% from 13 to 45 km.

POAM/SOLVE-1 Comparisons



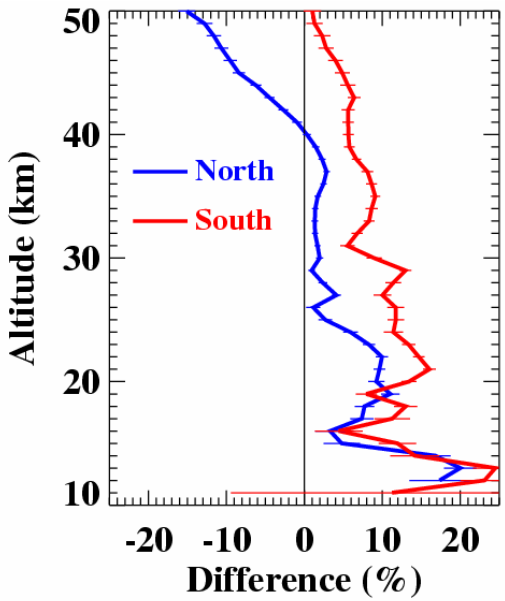
Lumpe et al., JGR, 2002

- Balloon and airplane-based measurements during SOLVE-2 unlikely to narrow ±5% uncertainty.
- DC-8 lidar measurements most useful for relative measurements along occultation paths.
- Balloon measurements most important below 13 km.

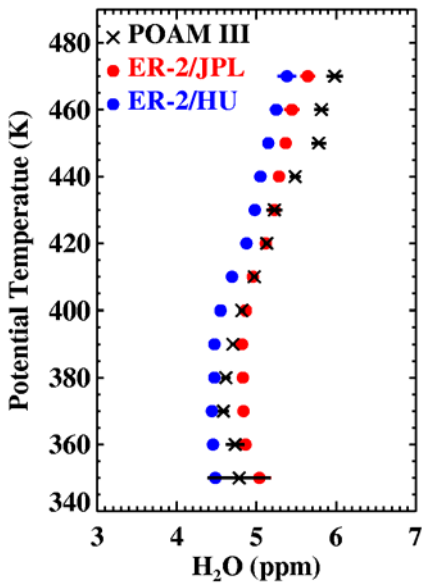
Use of POAM Data in the SOLVE-2 Campaign: H_2O

- Statistical POAM/SAGE comparisons important because few other water measurements to be made during SOLVE-2.

- Balloon-borne Mk-IV and frost point measurements made during SOLVE-2 important for calibrating statistical comparisons.

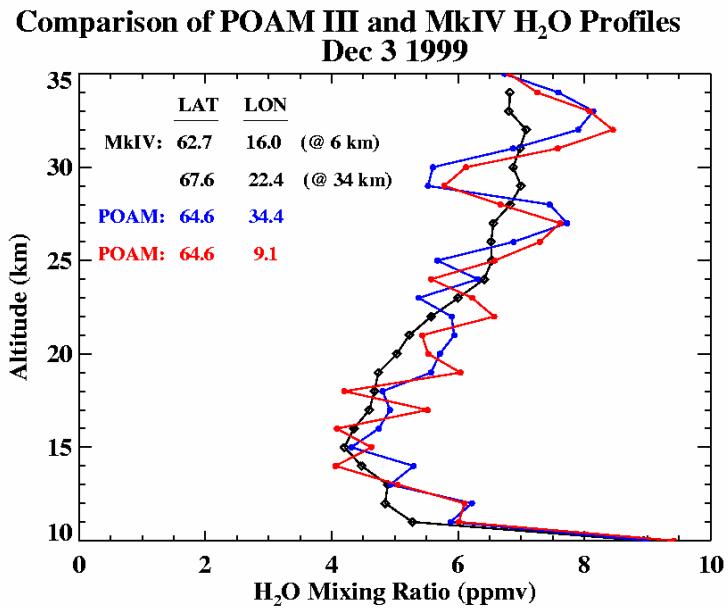


POAM/ HALOE Summary



SOLVE-1 Comparisons

Bevilacqua et al., in prep., 2002

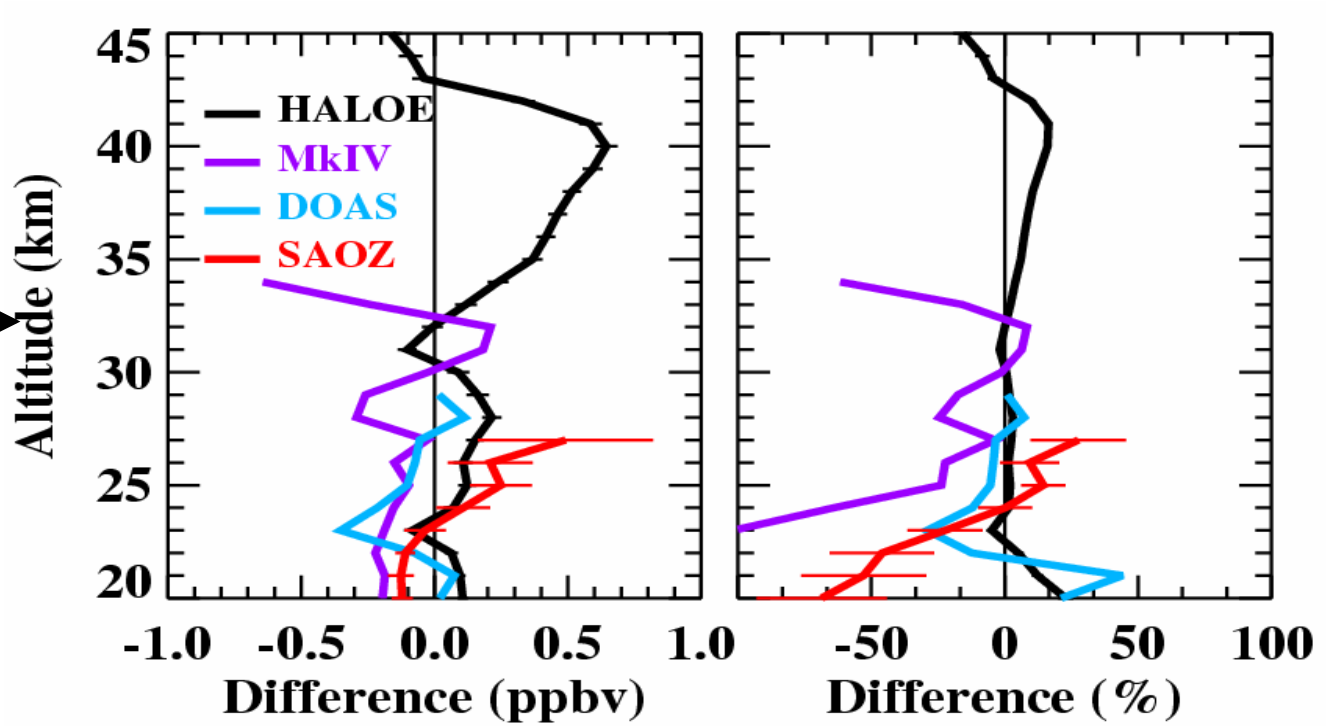


Use of POAM Data in the SOLVE-2 Campaign: N_2O

- POAM comparisons made during SOLVE-1 showed larger differences in the lower stratosphere than expected from the POAM/HALOE statistical comparisons.

- POAM/SAGE statistical comparisons (along with balloon-borne comparisons during SOLVE-2) will allow examination of this issue.

HALOE and SOLVE NO_2 Comparisons



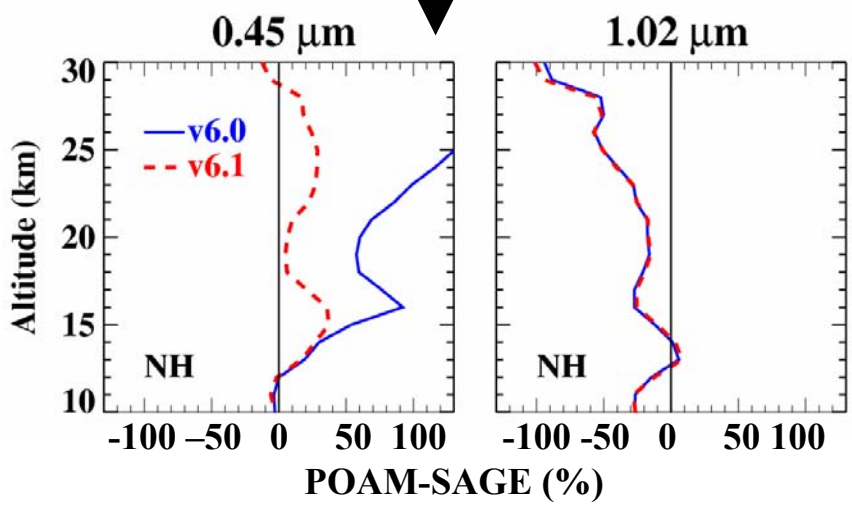
Randall et al., JGR, 2002

Use of POAM Data in the SOLVE-2 Campaign: Aerosols and PSCs

- How well satellites can measure aerosol extinction in the present low aerosol loading environment is still an open question.

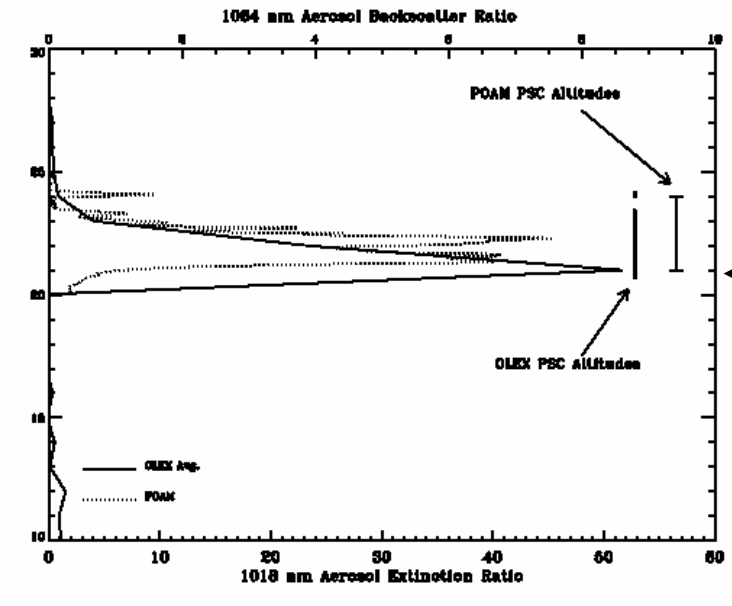
- POAM/SAGE III comparisons (in light of the extensive POAM/SAGE II comparisons) can be important here.

POAM/SAGE II Aerosol Extinction Comparisons



Randall et al., JGR, 2002

POAM/DLR PSC Measurement

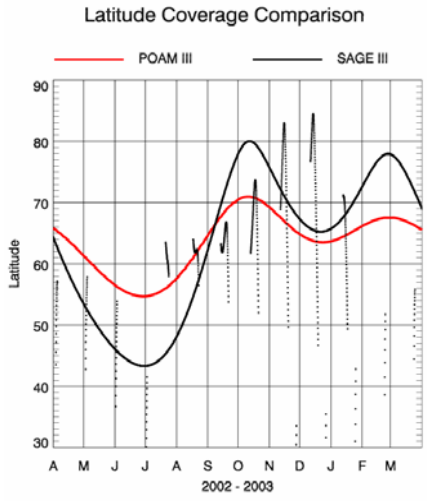


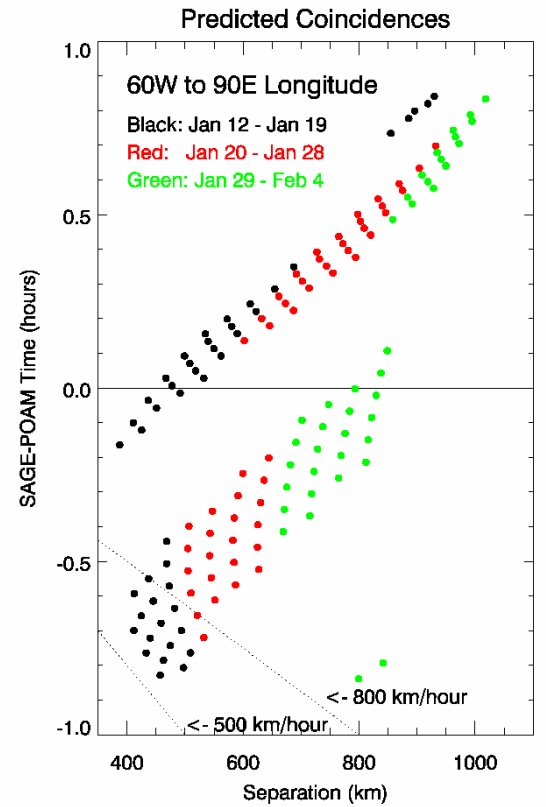
- The suitability of satellite measurements for PSC detection can be well tested with POAM and SAGE comparisons with DC-8 lidar measurements.

Use of POAM Data in the SOLVE-2 Campaign: Validation Techniques

Direct Coincidence Comparisons:

- POAM and SAGE will be within 3 degrees from about 15 Nov through 15 Jan. (SAGE always north of POAM), and there is a SAGE lunar occultation measurement coincidence with POAM.
- SAGE measurements will be in closest coincidence to Esrange in mid-Jan., and POAM will be in closest coincidence in early Feb.



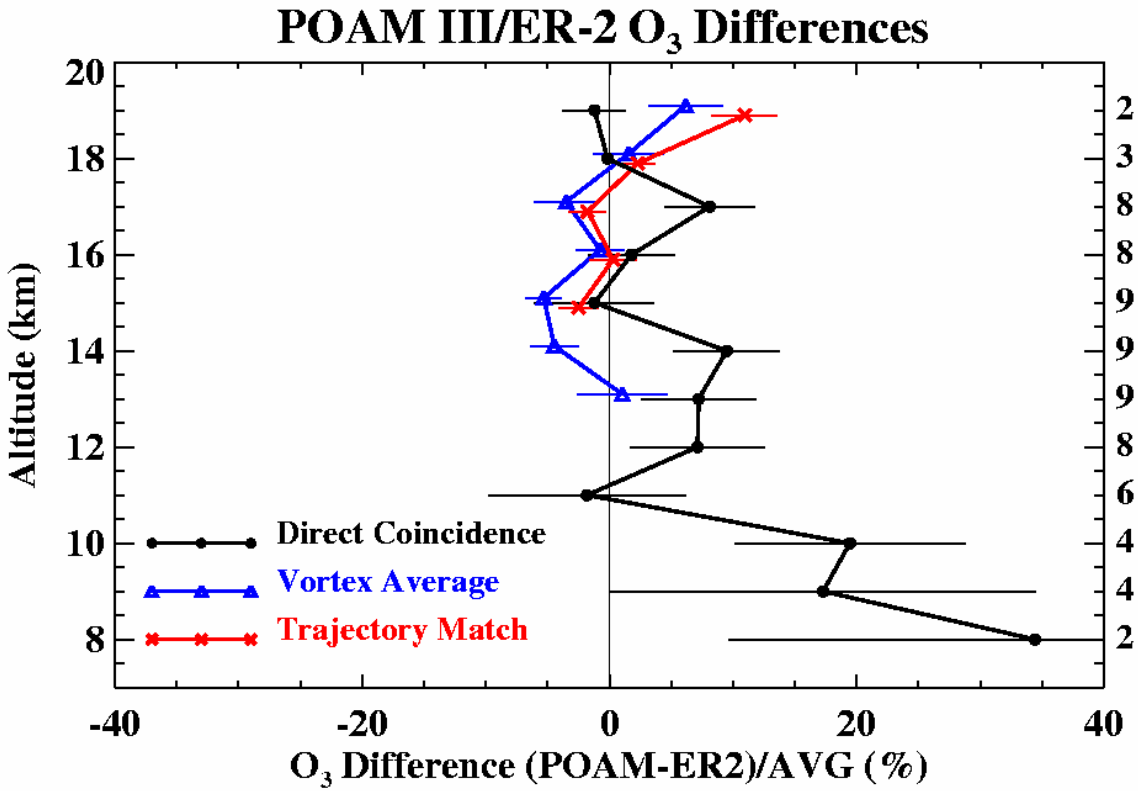


- It should be possible for the DC-8 to overfly both POAM and SAGE. This will be very valuable for ozone and PSC measurement comparisons.

Use of POAM Data in the SOLVE-2 Campaign: Validation Techniques

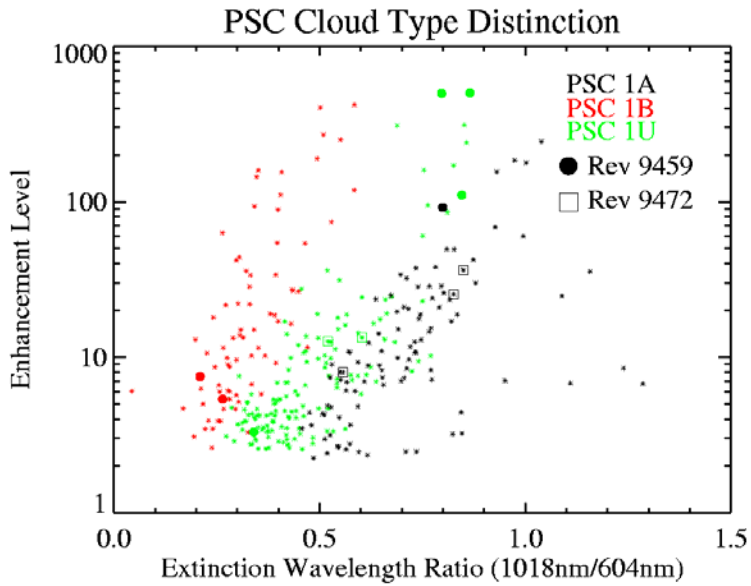
Similar air mass comparisons:

- **Trajectory mapping**
- **Vortex average comparisons**



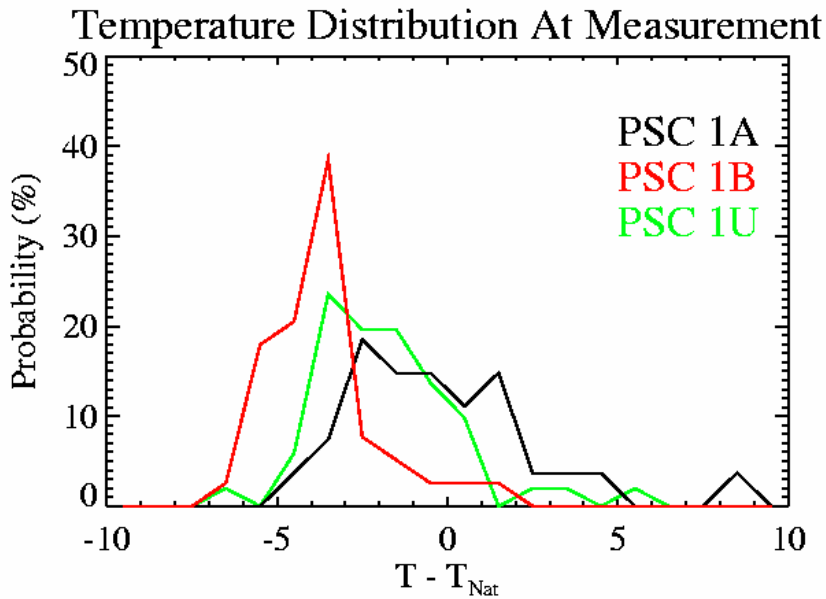
Lumpe et al., JGR, 2002

Use of POAM Data in the SOLVE-2 Campaign: PSC analysis



POAM PSC type discrimination algorithm by Strawa et al. (2002) applied to PSCs observed during the SOLVE-1 winter: *Type 1A (NAT) clouds have relatively high extinction ratios and low extinctions.*

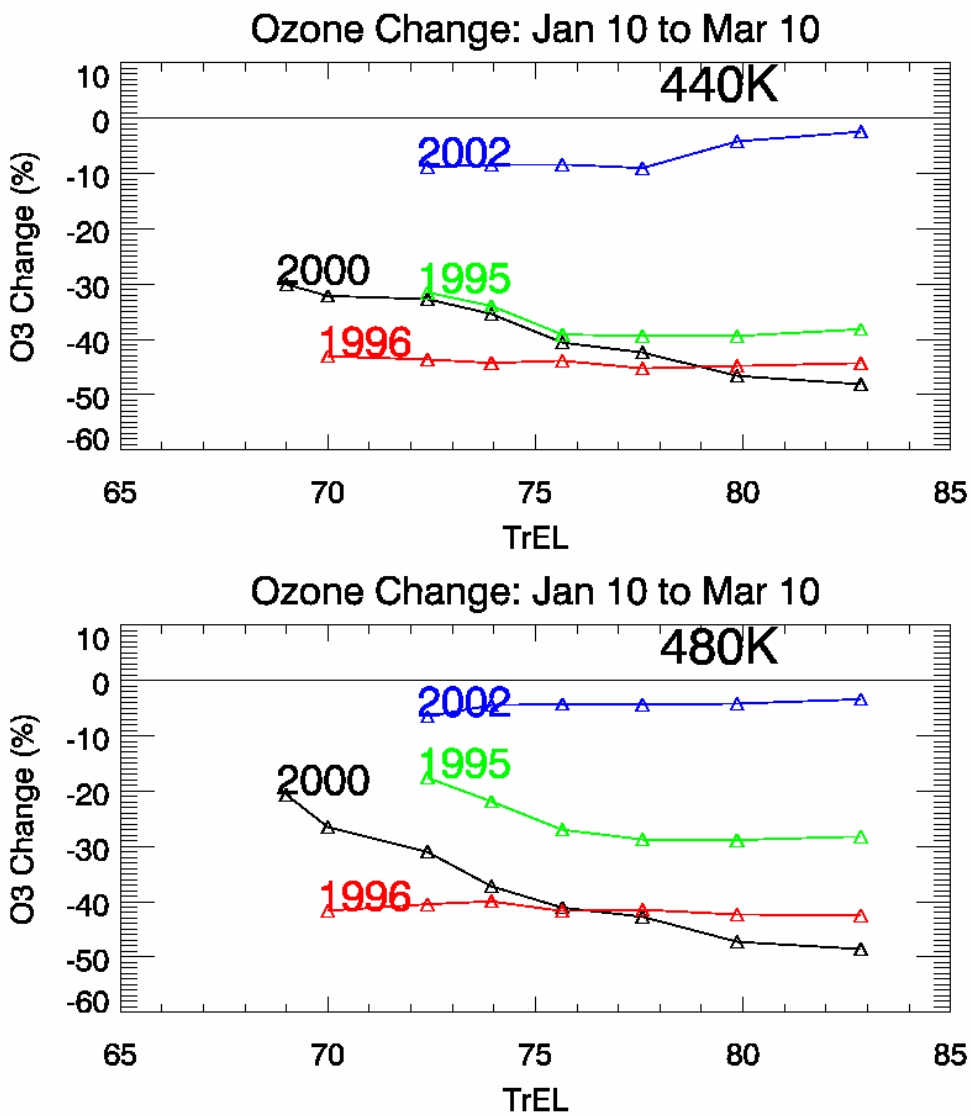
Temperature distribution (UKMO) of PSC types observed by POAM during the SOLVE-1 winter. *Type 1A clouds are observed at a larger range of temperatures than Type 1B*



Use of POAM Data in the SOLVE-2 Campaign: Ozone Loss

Ozone loss, for the indicated northern hemisphere stable winters in which POAM data is available, as a fct. of equivalent latitude estimated using POAM ozone measurements and vortex average descent rates (determined using Joan Rosenfield's net heating rates and a diabatic trajectory code).

Hoppel et al., JGR, 2002

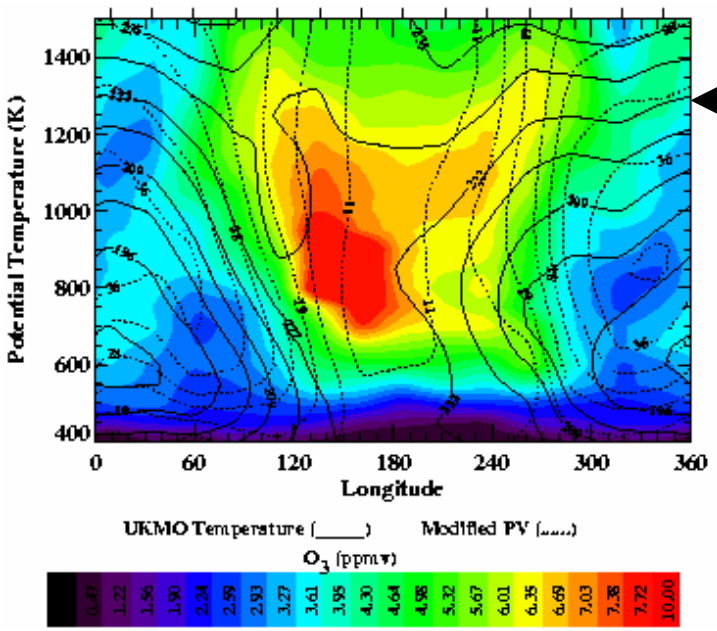


Use of POAM Data in the SOLVE-2 Campaign: Products

POAM Data Products for SOLVE-2:

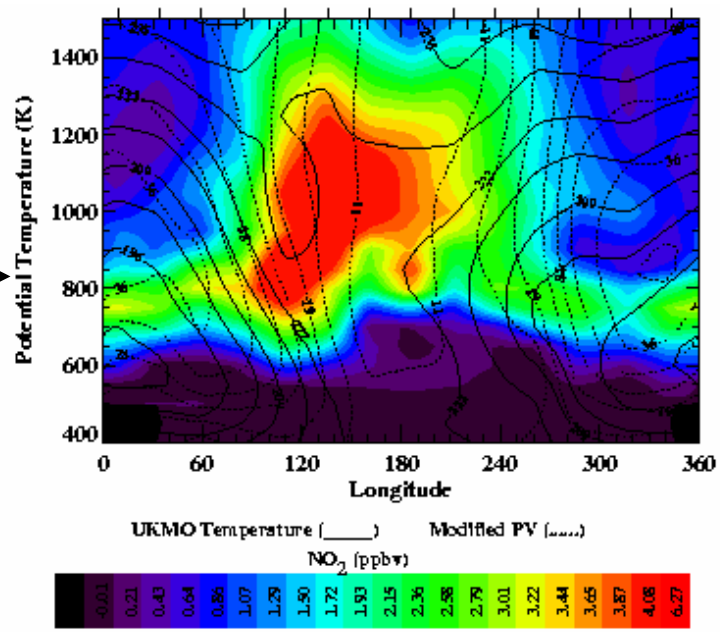
- **POAM data files delivered to the SOLVE-2 web site within 24 hours of receipt: ozone, water vapor, NO2, concentration and mixing ratios, and aerosol extinction on 1 km grid.**
- **POAM PSC catalog**
- **Daily maps**
- **Proxy ozone fields.**

Use of POAM Data in the SOLVE-2 Campaign: Daily Maps

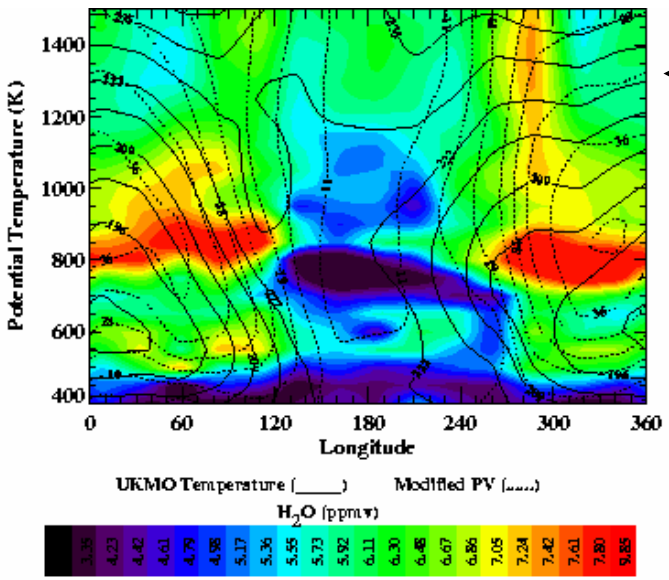


Ozone

NO_2

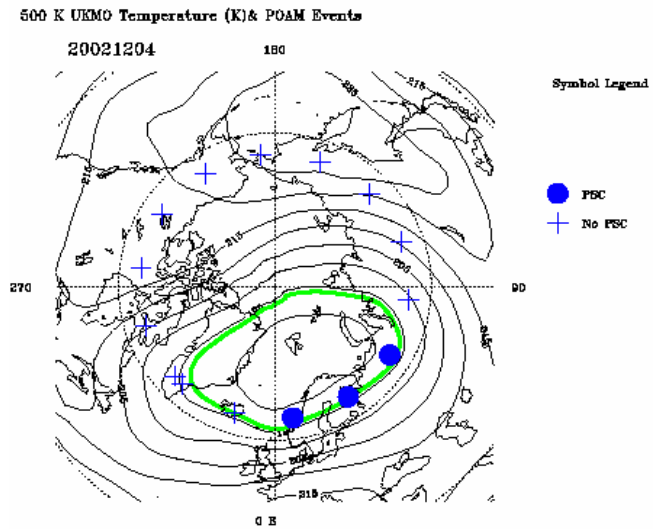


4 Dec., 2002



H_2O

PSCs



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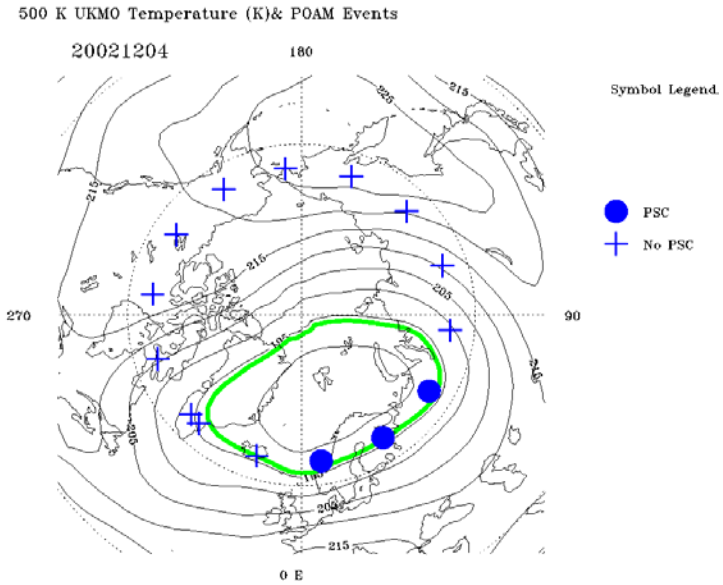
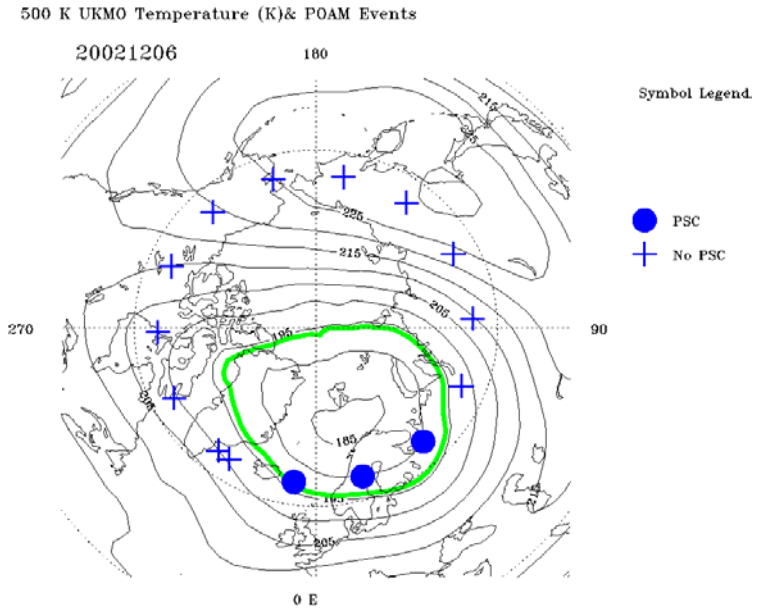
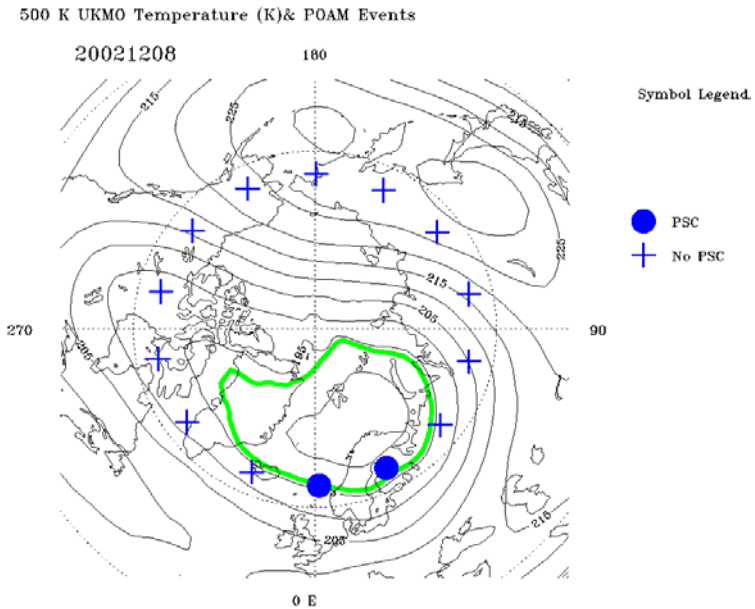
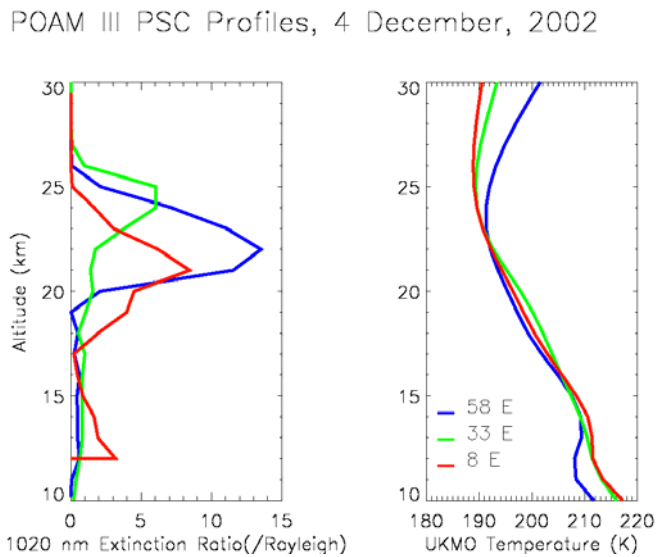




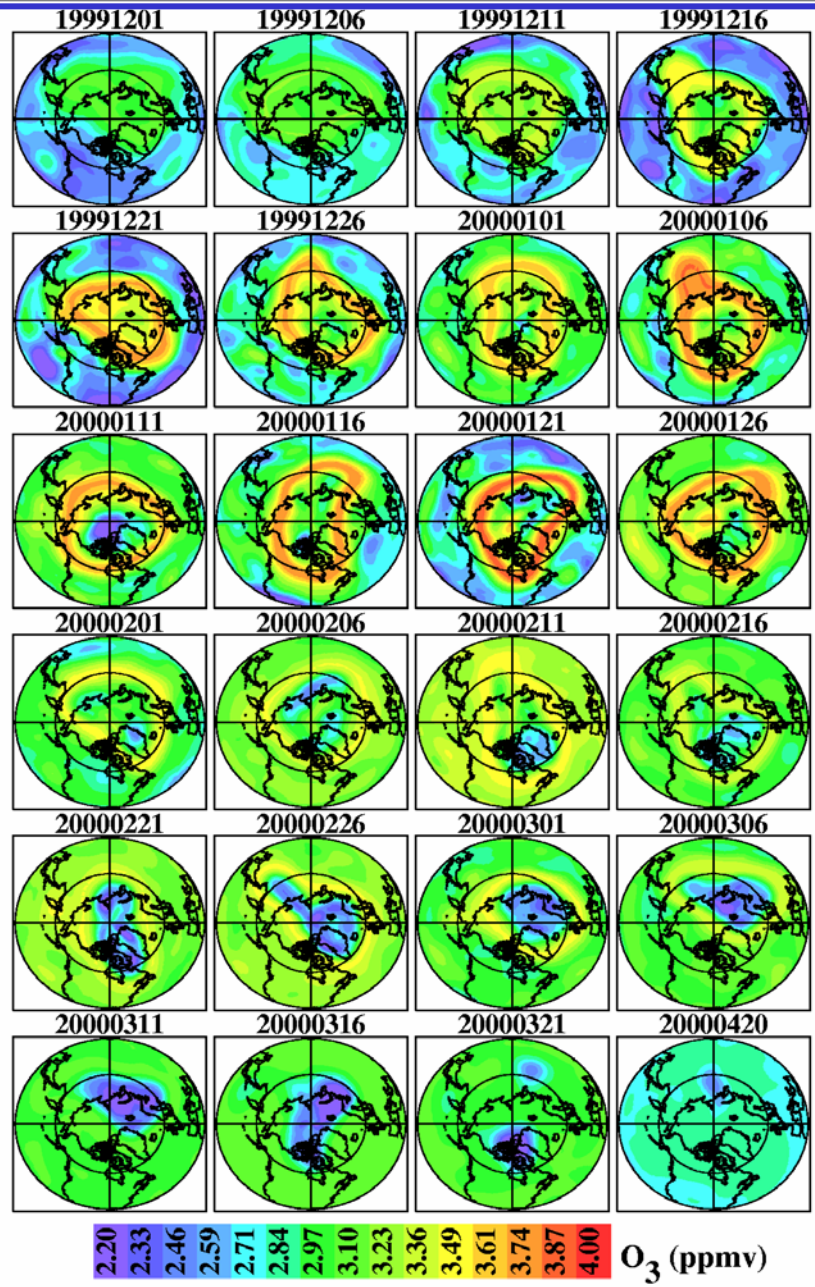




Use of POAM Data in the SOLVE-2 Campaign: Proxy

Evolution of POAM proxy ozone *(determined using pv correlations)* on the 500 K potential temperature surface in the 1999/00 northern hemisphere winter.

Randall et al., JGR, 2002



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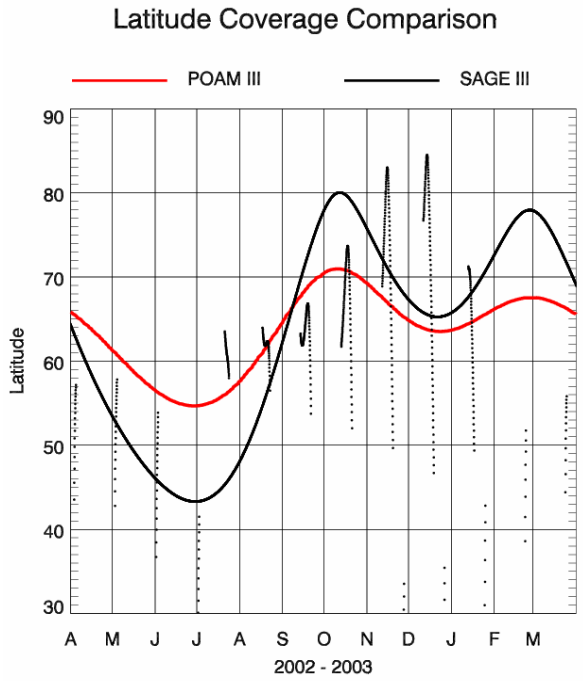

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